Claims 1 to 25 were pending when last examined. Applicant has amended claims 4 to 7, 9 to 14, 16 to 21, and 24. Claims 1 to 25 remain pending.

Notice of Non-Compliant Amendment

Applicant has provided the proper status identifier for claim 6 in the listing of the claims.

§ 103 Rejections

Claims 1 to 3, 22, 23, and 25

The Examiner rejected claims 1 to 3, 22, 23, and 25 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application No. 2005/0047656 ("Luo") in view of U.S Patent No. 6,728,401 B1 ("Hardeberg"). Addressing claim 1, the Examiner stated:

> As to claim 1, Luo discloses a method for removing red eye from an image, comprising: calculating a weighted red value for each pixel in the image based on (1) red, green, and blue color values and (2) <u>a luminance of each pixel in the image (page 3 [0061-0064] – equation 1 is based on r, g, b, and a luminance value in the denominator</u> and by modifying the weighing [sic] factors it can be weighted for red values); selecting a plurality of pixels in the image having weighted red values greater than a threshold as red eye pixels 88 (fig. 9, page 4 [0065-0072] – the final redness map containing a plurality of selected pixels); and correcting the red eye pixels to remove the red eye from the image (page 1 [0009], page 10 [0128-0129]).

> Luo does not expressly disclose calculating a weight for each pixel.

> Hardeberg does disclose calculating a weight red value for each pixel in the image 230 (fig. 2, col. 4 lines 7-17 – specifically when an ROI is not defined, as it is optional).

October 5, 2007 Office Action, pp. 2 and 3 (emphasis added). Applicant respectfully traverses.

The cited figures and text of Luo do not disclose calculating a weighted red value for each pixel in an image based on red, green, and blue color values and <u>a luminance</u> of the pixel as recited in claim 1. Instead, Luo discloses calculating a pixel redness R using an equation 1:

$$R = \frac{\alpha \cdot r + \beta \cdot g + \gamma \cdot b}{r + g + b + d},$$

where "r," "g," and "b" are the red, green, and blue color values of the pixel, respectively, "α," "β," and "γ" are the weighting factors for the red, green, and blue color values, respectively, and "d" is a prescribed constant with a value selected to avoid singularities and to give higher weights to bright pixels. Pixel redness R is not based on a luminance of the pixel. Applicant notes that the denominator of equation 1 is an expression of the total pixel energy (i.e., color) and not an expression of the luminance of the pixel. "In some embodiments, the pixel redness measures are computed based on a ratio of a measure of a red component of pixel energy to a measure of total pixel energy." Lou, paragraph [0061] (emphasis added). Should the Examiner disagree, Applicant respectfully requests the Examiner to provide a reference that defines the luminance of a pixel in the same manner as the denominator of equation 1.

Hardeberg does not cure the deficiency of Luo. Accordingly, claim 1 is patentable over the combination of Luo and Hardeberg because they fail to disclose all the elements of claim 1.

Claims 2, 3, and 22 depend from claim 1 and are patentable over the cited references for at least the same reasons as claim 1.

Claim 23 provides a specific equation for calculating a weighted red value of each pixel based on the luminance, the red chrominance, and the blue chrominance of that pixel. As discussed above with regards to claim 1, neither Luo nor Hardeberg calculates a weighted red value of a pixel based on, inter alia, the luminance of the pixel. For at least the same reasons, claim 23 is patentable over the combination of Luo and Hardeberg.

Claim 25 depends from claim 23 and is patentable over the cited references for at least the same reasons as claim 23.

Claims 4, 5, and 24

The Examiner rejected claims 4, 5, and 24 under 35 U.S.C. §103(a) over Luo, Hardeberg, and U.S. Patent Application No. 2004/0240747 A1 ("Jarman"). Addressing claim 4, the Examiner cited Figs. 2 to 9 and p. 4, paragraphs [0086] to [0091] of Jarman for disclosing different types of weighted red values. Applicant respectfully traverses.

Claim 4 depends from claim 1 and is patentable over the cited references for at least the same reasons as claim 1. In addition, claim 4 is further patentable for the following reason.

Claim 4 recites steps for calculating <u>two types of weighted red values for each pixel</u>. For example, the two types of weighted red values are the weighted purple-red value and the weighted orange-red values disclosed in the present application.

The cited figures and text of Jarman do not disclose two types of weighted red values <u>for each pixel</u>. Instead, Jarman discloses scanning a row of pixels and <u>determining if a set of pixels corresponds to one of three types of red eye highlights</u>. Specifically, for a Type 1 highlight, Jarman scans a row of pixels and <u>identifies a set of pixels</u> with saturation, lightness, and red hue values that signify rising and failing edges of a highlight. <u>See</u> Jarman, paragraphs [0093] to [0106]. For a Type 2 highlight, Jarman scans a row of pixels and <u>identifies a set of pixels has a saturation pattern specified in the table of paragraph [0116]</u>, and then determine if <u>the set of pixels has a lightness, saturation, and hue pattern specified in the table of paragraph [0117]</u>. <u>See</u> Jarman, paragraphs [0107] to [0120]. For a Type 3 highlight, Jarman searches a first derivate of the lightness of a row of pixels and determines if <u>a set of pixels meets a pattern specified in the table of paragraph [0123]</u>. <u>See</u> Jarman, paragraphs [0121] to [0127].

Lou and Hardeberg do not cure the deficiency of Jarman. Thus, claim 4 is patentable over the combination of Lou, Hardeberg, and Jarman because they fail to disclose all the elements of claim 4.

Claim 5 depends from claim 4 and is patentable over the cited references for at least the same reasons as claim 4.

Claim 24 depends from claim 23 and is patentable over the cited references for at least the same reasons as claim 23. In addition, claim 24 is further patentable over the cited references for the following reasons.

Similar to claim 4, claim 24 recites steps for calculating <u>two types of weighted red values for each pixel</u> based on the blue, red, and green color values and the luminance of the pixel. On the other hand, Jarman discloses scanning a row of pixels and determining if a set of pixels corresponds to one of three types of red eye highlights. Thus, claim 24 is patentable over the combination of Lou, Hardeberg, and Jarman.

<u>Claims 6, 9, 10, 13, and 18</u>

The Examiner rejected claims 6, 9, 10, 13, and 18 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, and U.S. Patent No. 7,042,505 B1 ("DeLuca").

Claims 6, 9, 10, 13, and 18 depend from claim 1 and are patentable over the cited references for at least the same reasons as claim 1.

Claim 7

The Examiner rejected claim 7 under §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, and U.S. Patent No. 6,714,665 B1 ("Hanna"). Specifically, the Examiner cited col. 48, lines 30-63 of Hanna for disclosing determining whether a red eye region is substantially a round pupil as recited in claim 7. Applicant respectfully traverses.

Claim 7 depends from claim 1 and is patentable over the cited references for at least the same reasons as claim 1. In addition, claim 7 is further patentable for the following reasons.

Claim 7 recites steps for determining if a red eye region is substantially a round pupil. The steps include (1) determining a radius that provides the largest difference in weighted red values on the radius and the next radius in a range of radii, (2) setting the determined radius as the pupil radius, (3) determining a first ratio between (a) the number of red eye pixels located in a circle having the pupil radius to (b) the area of the radius, (4) determining a second ratio between (a) the number of red eye pixels located in a ring having the pupil radius as its inner radius and a maximum radius in the range of radii as its outer radius to (b) the area of the ring, and (5) determining a difference between the ratios. When the difference is less than a threshold, then the red eye region is not substantially round.

The cited text of Hanna discloses an entirely different method to determine if a candidate center point is a center point of a circular feature. For each spoke 2250 extending from a candidate center point 2240, Hanna searches for an edge on the spoke that has a magnitude greater than a threshold and an orientation that most closely matches a predicated edge orientation. Hanna next discards edges that are much farther than a median distance from candidate center point 2240. Hanna then determines a cost for candidate center point 2240 based on the remaining edges as follows:

> This cost is the sum of the absolute difference between the predicted edge orientation and the measured orientation, multiplied by a normalization factor and added to the sum of the absolute difference between the median radius and the measured radius, multiplied by a normalization factor. .... For a perfect circle, this cost is zero.

Hanna, col. 48, lines 56 to 63. Hanna repeats the above for multiple candidate center points and selects the candidate center point that produces the lowest cost below a threshold as the center point for the eye. As the Examiner can see, Hanna discloses entirely different steps than claim 7.

Luo, Hardeberg, and DeLuca do not cure the deficiency of Luo. Accordingly, claim 7 is patentable over the combination of Luo, Hardeberg, DeLuca, and Hanna because they fail to disclose all the elements of claim 7.

Claim 8

The Examiner rejected claim 8 under 35 U.S.C. §103(a) as being unpatentable under Luo, Hardeberg, DeLuca, Hanna, and U.S. Patent No. 7,155,058 ("Gaubatz"). Specifically, the Examiner asserted that a pixel 804e in Fig. 8 of Gaubatz to be the farthest red eye pixel in a red eye region and then concluded that Gaubatz discloses a range of radii from 0.5 to 1.5 times the distance from a geometric center of the red eye region to the farthest red eye pixel. Applicant respectfully traverses.

Claim 8 depends from claim 7 and is patentable over the cited references for at least the same reasons as claim 7. In addition, claim 8 is further patentable for the following reasons.

Claim 8 recites a range of radii used for determining if a red eye region is a substantially round pupil. The range is specified as 0.5 to 1.5 times a distance from the geometric center of a red eye region to the farthest red eye pixel of the red eye region.

Figs. 8 and 9 of Gaubatz illustrate the steps of the method in Fig. 7 for generating a luminance intermediate mask. Gaubatz discloses extracting pixels located along each radial extending from a center 804 to a perimeter 802 of a red eye candidate box 800. Starting from the pixel on the radial that has the lowest luminance, Gaubatz identifies the first pixel that exceeds a predetermined luminance threshold as it moves out on the radial toward perimeter 802. Gaubatz then sets the mask values of the first pixel and subsequent pixels on the radial to 0.

As the Examiner can see, pixel 804e is simply the fifth of seven pixels on a radial 806d. Gaubatz does not disclose determining the farthest pixel of a region, let alone a red eye region formed from red eye pixels, and then determining a range of radii based on the distance from the farthest pixel to the geometric center of the region. Instead, Gaubatz processes all the pixels on each radial extending from center 804 to perimeter 802 of box 800.

Luo, Hardeberg, DeLuca, and Hanna do not cure the deficiencies of Gaubatz. Accordingly, claim 8 is patentable over Luo, Hardeberg, DeLuca, Hanna, and Gaubatz because they fail to disclose all the elements of claim 8.

Claim 11

The Examiner rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, and Gaubatz. Specifically, the Examiner cited Figs. 8 and 9 and col. 15, lines 18 to 57 for disclosing the steps of claim 11 for determining a pupil radius. Applicant respectfully traverses.

Claim 11 depends from claim 10 and is patentable over the cited references for at least the same reasons as claim 10. In addition, claim 11 is further patentable for the following reasons.

Claim 11 recites steps for determining a pupil radius of a red eye region. The steps include determining a radius that provides the largest difference in weighted red values on the radius and the next radius in a range of radii, and setting the determined radius as the pupil radius. Essentially, claim 11 recites comparing weighted red values of corresponding pixels on adjacent circles.

As described above regarding claim 8, Figs. 8 and 9 of Gaubatz illustrate the steps of the method in Fig. 7 for generating a luminance intermediate mask. Gaubatz discloses extracting pixels located along each radial extending from center 804 of box 800. Starting from the pixel on the radial that has the lowest luminance, Gaubatz identifies the first pixel that exceeds a predetermined luminance threshold as it moves out on the radial toward perimeter 802 of box 800. Gaubatz then sets the mask values of the first pixel and subsequent pixels on the radial to 0. Essentially, Gaubatz discloses comparing the luminance value of the pixels on each radial to a fixed threshold.

Luo, Hardeberg, and DeLuca do not cure the deficiencies of Gaubatz. Accordingly, claim 11 is patentable over the combination of Luo, Hardeberg, DeLuca, and Gaubatz because they fail to disclose all the elements of claim 11.

Claim 12

The Examiner rejected claim 12 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, Gaubatz, and U.S. Patent Application No. 2005/0196067 A1 ("Gallagher"). Specifically, the Examiner cited paragraphs [0083] to [0094] of Gallagher for disclosing the term

"R_D*T_3" as the range of distances recited in claim 12 for determining if two red eye regions are too close to each other as. Applicant respectfully traverses.

Claim 12 depends from clam 11 and is patentable over the cited references for at least the same reasons as claim 11. In addition, claim 12 is further patentable for the following reasons.

Claim 12 recites steps that determine two red eye regions are too close to each other when the distance between them is within <u>a range of 10 to 14 times a pupil radius</u>. On the other hand, the cited text of Gallagher discloses a size limiter 134 that removes pixels that have a distance to the centroid of a red eye defect region <u>greater a second size limit</u>. The second size limit is defined as $S_{L2} = R_D*T_3+T_4$, <u>where R_D is defined as the distance between red eye defects, and T_3 is a constant between 0.05 and 0.1 (e.g., 0.072)</u>. <u>See</u> Gallagher, paragraphs [0083] to [0094]. As the Examiner can see, R_D is the distance between red eye defects and not a pupil radius, and T3 is a single constant (e.g., 0.072) instead of a range of values. Furthermore, the suggested values for the single constant (0.05 to 0.1) is very different from the recited range (10 to 14) recited in claim 12.

Luo, Hardeberg, DeLuca, and Gaubatz do not cure the deficiency of Gallagher. Accordingly, claim 12 is patentable over the combination of Luo, Hardeberg, DeLuca, Gaubatz, and Gallagher because they do not disclose all the elements of claim 12.

<u>Claim 14</u>

The Examiner rejected claim 14 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, and U.S. Patent No. 7,035,461 B2 ("Luo1"). Specifically, the Examiner first found that col. 4, lines 12 to 16 of DeLuca disclose, in a ring having inner and outer radii proportional to a pupil radius of a red eye region, rejecting red eye pixels if the most common color in the red eye region is not within a range of skin colors. The Examiner then found that Fig. 3 and col. 2, lines 5 to 6 of Luo1 disclose generating a histogram, selecting a most common color value in the histogram, and comparing the most common color to a range of threshold skin colors. Applicant respectfully traverses.

Claim 14 depends from claim 13 and is patentable for at least the same reasons as claim 13. In addition, claim 14 is further patentable for the following reasons.

Claim 14 recites steps for determining if a red eye region is close to a facial region. Applicant has amended claim 14 to correct a typographical error. The steps now include generating a histogram

for pixels in a ring having inner and outer radii proportional to a pupil radius of the red eye region, <u>selecting a most common color value in the histogram (i.e., the most common color in the ring)</u>, comparing the most common color value to a range of skin colors, and rejecting the red eye pixels that form the red eye region when the most common color is not in the range of skin colors. Essentially, claim 14 recites rejecting the red eye region when the most common color of a ring around the red eye region is not a skin color.

The cited text of DeLuca discloses additional tests to determine if a round group of pixels having color indicative of a red eye should be modified to remove the red eye. Specifically, DeLuca discloses determining if there are no other pixels within the vicinity of the grouping having a similar red color, where the vicinity is preferably between two to five times the radius of the grouping. DeLuca also discloses detecting iris pixels around the pupil pixels, and eye white pixels around the pupil pixels. However, DeLuca does not disclose rejecting the grouping when the most common color of a ring around the grouping has a skin color.

The cited figure and text of Lou1 disclose generating a histogram, replacing the value of each bin of the histogram with a weighted average of the value of that bin and the values of its immediate neighbors, finding peak values in the histogram, assigning the peak value to bins that are located closest to it, and generating a segmented image where the pixels have a color equal to the number of the peak that it was assigned to. Lou1 does not select the most common color out of a histogram to compare it with a range of skin colors.

Luo and Hardeberg do not cure the deficiency of DeLuca and Lou1. Accordingly, amended claim 14 is patentable over the combination of Luo, Hardeberg, DeLuca, and Lou1 because they do not disclose all the elements of amended claim 14.

<u>Claim 15</u>

The Examiner rejected claim 15 under §103 (a) as being unpatentable over Luo, Hardeberg, DeLuca, Luo1, and U.S. Patent Application No. 6,895,112 ("Chen"). The Examiner found that col. 3, lines 34 to 51 of Chen disclose comparing the most common color value in HSV color space to the range of threshold skin colors. Applicant respectfully traverses.

Claim 15 depends from amended claim 14 and is patentable over the cited references for at least the same reasons as amended claim 14. In addition, claim 15 is further patentable for the following reasons.

The cited text of Chen does not disclose any comparison between the most common color values and threshold skin colors. Rather, Chen discloses <u>segmentation of quantized color image according to skin color characteristics based on either the YCbCr or HSV color model.</u> <u>See</u> Chen, col. 3, lines 43-45. The mere mention of YCbCr/HSV color space in Chen does not necessarily motivate one of ordinary skill in the art to modify the previous red eye region detection to further carry out skin tone comparison in the HSV color space.

Lou, Hardeberg, DeLuca, and Lou1 do not cure the deficiency of Chen. Accordingly, claim 15 is patentable over the combination of Luo, Hardeberg, DeLuca, Lou1,and Chen because they do not disclose all the elements of claim 15.

<u>Claim 16</u>

The Examiner rejected claim 16 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, Luo1, and Gaubatz. The Examiner essentially rejected claim 16 for the same reason as claim 11. Applicant respectfully traverses.

Claim 16 depends from amended claim 14 and is patentable over the cited references for at least the same reasons as amended claim 14. In addition, claim 16 is further patentable for the following reasons.

Similar to claim 11, claim 16 recites <u>comparing weighted red values of corresponding pixels on adjacent circles to determine a pupil radius of a red eye region.</u> On the other hand, Gaubatz discloses <u>comparing the luminance value of the pixels on each radial to a fixed threshold.</u> For similar reasons as claim 11, claim 16 is patentable over the combination of Luo, Hardeberg, DeLuca, Lou1, and Gaubatz because they do not disclose all the elements of claim 16.

<u>Claim 17</u>

The Examiner rejected claim 17 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, Luo1, Gaubatz, and Gallagher. The Examiner essentially rejected claim 17 for the same reason as claim 12. Applicant respectfully traverses.

Claim 17 depends from claim 16 and is patentable over the cited references for at least the same reasons as claim 16. In addition, claim 17 is patentable for the following reasons.

Claim 17 recites that the values of the inner and the outer radii for a ring about a red eye region used to determine if the red eye region is close to a facial region are 4 to 9 times a pupil radius of the red eye region. As discussed earlier with claim 12, Gallagher discloses a second size limit defined as $S_{L2} = R_D*T_3+T_4$, where R_D is defined as the distance between red eye defects, and T_3 is a constant between 0.05 and 0.1 (e.g., 0.072). As the Examiner can see, R_D is the distance between red eye defects and not a pupil radius, and T3 is a single constant instead of a range of values. Furthermore, the suggested values for the single constant (0.05 to 0.1) is very different from the recited range (4 to 9) recited in claim 17.

Luo, Hardeberg, DeLuca, Luo1, and Gaubatz do not cure the deficiencies of Gallagher. Accordingly, claim 17 is patentable over the combination of Luo, Hardeberg, DeLuca, Gaubatz, and Gallagher because they do not disclose all the elements of claim 17.

Claim 19

The Examiner rejected claim 19 under 35 U.S.C. §103(a) as being unpatentable over Luo, Hardeberg, DeLuca, and U.S. Patent No. 6,204,858 B1 ("Gupta"). The Examiner found that Fig. 2, col. 2, line 62, and col. 4, lines 42 to 59 of Gupta disclose the steps of claim 19. Applicant respectfully traverses.

Claim 19 recites steps for determining if a red eye region is close to a sclera. The steps include generating a luminance histogram for pixels in a ring having inner and outer radii proportional to a pupil radius of the red eye region, selecting a brightest color in the luminance histogram, determine a ratio between the number of pixels in the ring having the brightest color to the number of red eye pixels within a circle having the pupil radius, and rejecting the red eye pixels that make up the red eye region if the ratio is less than a threshold.

The cited figure and text of Gupta discloses calculating convolutions of circular and ring shaped filters and then applying various tests to determine if the convolutions identified possible red eye candidates (e.g., if the convention values exceed a predetermined threshold). As the Examiner can see, Gupta does not disclose the steps recited by claim 19 for determining if a red eye region is close to a sclera.

Luo, Hardeberg, and DeLuca do not cure the deficiencies of Gupta. Accordingly, claim 19 is patentable over the combination of Luo, Hardeberg, DeLuca, and Gupta because they do not disclose all the elements of claim 19.

<u>Claims 20 and 21</u>

The Examiner rejected both claims 20 and 21 under 103 (a) as being unpatentable over Luo, Hardeberg, DeLuca, and Gaubatz. The Examiner essentially rejected claim 20 for the same reason as claim 11. The Examiner then found that Figs. 8 and 9 of Gaubatz disclose the inner and outer radii of a ring a red eye region used to determine if the red eye region is close to a sclera are 2 to 5 times a pupil radius of the red eye region. Applicant respectfully traverses.

Claim 20 depends from claim 19 and is patentable over the cited references for at least the same reasons as claim 19. In addition, claim 20 is further patentable for the following reasons.

Similar to claim 11, claim 20 recites <u>comparing weighted red values of corresponding pixels on adjacent circles to determine a pupil radius of a red eye region</u>. On the other hand, Gaubatz discloses <u>comparing the luminance value of the pixels on each radial to a fixed threshold</u>. For similar reasons as claim 11, claim 20 is patentable over the combination of Luo, Hardeberg, DeLuca, and Gaubatz because they do not disclose all the elements of claim 20.

Claim 21 depends from claim 20 and is patentable over the cited references for at least the same reasons as claim 20. In addition, claim 21 is further patentable for the following reasons.

Claim 21 recites the values of inner and the outer radii for a ring about a red eye region used to determine if the red eye region is close to a sclera are 2 to 5 times the pupil radius of the red eye region. As described above regarding claim 8, Figs. 8 and 9 of Gaubatz disclose processing all pixels on each radial extending from center 804 to perimeter 802 of box 800 instead of a specific range of radii.

Luo, Hardeberg, and DeLuca do not cure the deficiencies of Gaubatz. Accordingly, claim 21 is patentable over Luo, Hardeberg, DeLuca, and Gaubatz because they fail to disclose all the elements of claim 21.

Serial No. 10/826,108

Summary

In summary, claims 1 to 25 were pending in the above-identified application when last examined. Applicant has amended claims 4 to 7, 9 to 14, 16 to 21, and 24. Claims 1 to 25 remain pending. For the above reasons, Applicant respectfully requests the Examiner to withdraw the claim rejections and allow claims 1 to 25. Should the Examiner have any questions, please call the undersigned at (408) 382-0480.

Respectfully submitted,

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